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THE NATIONAL ACADEMY OF SCIENCES

ABSTRACTS OF PAPERS PRESENTED AT THE WASHINGTON MEETING

AT the annual meeting of the National Academy of Sciences, held in Washington, D. C., on April 23 and 24, the following papers were presented:

Two large-fruited bud sports of Bartlett pear identified as tetraploids by pollen size: J. L. CARTLEDGE, A. D. SHAMEL and A. F. BLAKESLEE. The paper presents the results of a joint study of two freak branches which arose as bud sports on otherwise typical trees of the Bartlett pear. The peculiar branches were characterized by broader leaves and by larger flowers and fruits than normally occur on this variety. They were described by the second author in 1931 in one of a series of publications on bud sports of various types which he had found of not uncommon occurrence on different kinds of fruit trees. A chance reading of this article suggested to the other authors that the cause of the increased size of these sports might be due to their being tetraploids (that is, having twice as many chromosomes as are usually present). Such tetraploid sport branches have been found occasionally on jimson weeds. Since in these cases the doubling of chromosome number brings about similar increase in size of the parts affected, including pollen grains, it is possible to determine a tetraploid by merely looking at the pollen of one of its flowers without the tedious process involved in examining chromosomes. Flowers of the bud sports were sent from California, and both were found to have pollen grains of twice the volume of normals, a fact which indicates that they are tetraploids and have twice the number of chromosomes of normal Bartletts. A confirmation will be made by actual chromosome counts, but the use of pollen sizes to determine tetraploid mutations is a method which is available to any one with even a low power microscope and avoids the special technique necessary to chromosome study.

A lethal for ascus abortion in Neurospora: B. O. DODGE. Mutations or saltations observed in cultures of certain species of fungi following treatment with x-rays or ultra-violet light have been reported from time to time, but they have never been adequately tested out by the study of the progeny resulting from sexual reproduc-

tion. Such a test has been applied to certain abnormalities which followed x-ray treatment of ascospores of *Neurospora tetrasperma*. The ascospore normally contains two nuclei of opposite sex-reaction at its origin and these nuclei divide once more before the spore matures, showing that, between nuclear fusion at the origin of the ascus and spore germination, four successive simultaneous nuclear divisions occur. The x-ray treatment of the bisexual ascospore, from which the cultures studied were made, brought about a change in one or more of its four nuclei, with the result that the mycelium produced is much dwarfed or stunted, and only very rarely do the ascocarps that are formed in the culture produce asci with spores. Most of the perithecia are absolutely sterile. Mating this strain against tester strains separately it was found that there was an excellent mating reaction with tester strain S_1 ("sex B"). The ascocarps produced all contained some asci with from one to eight ascospores, and also large abnormal sterile asci in which no spores were ever delimited. Cytological examination proved that the fourth nuclear division in the ascus, not waiting for spore delimitation, immediately follows the third division, after which all sixteen nuclei undergo degeneration. The ascus wall takes over the color changes and wall markings characteristic for the ascospores themselves. That this condition can be passed on from generation to generation through sexual reproduction involving nuclear fusion and segregation of the factors concerned has been fully proved. The mechanism by which it is possible to observe through generations the effects of the original x-ray treatment in causing mutations is such that one can maintain, in culture, haploid races carrying 'lethal' factors which for other species of plants and animals could not be perpetuated in the haploid condition. The same or similar 'mutation' or abnormality reported here had previously been observed three or four times in cultures of *N. tetrasperma* and certain hybrids between that species and *N. sitophila*. These cultures had not been irradiated. It is clear that the same deficiency, gene mutation or condition, or whatever it is, that leads to ascus abortion can evidently arise again and again even without x-ray treatment. The 'lethal' action noted above can prevent spore germination so that it would not be easy to perpetuate races of unisexual species because the uninucleate ascospore would either be normal, or if it carried the 'lethal' condition, would not germinate at all. If such a spore did germinate its mycelium would be so greatly dwarfed that it would have little vitality and would probably die very early.

Anesthesia produced by distilled water: W. J. V. OSTERHOUT and S. E. HILL. In cells of the fresh-water plant *Nitella* stimuli are transmitted by negative variations which travel along the cell just as in muscle and nerve. Sufficient exposure of *Nitella* cells to distilled water abolishes the characteristic production of negative variations when stimulated by an electric current. This effect is accelerated by the addition of acid or of alkali and is inhibited by calcium. Irritability is restored when the cells are replaced in tap water. Evidently the protoplasmic surface is greatly modified, for after exposure to distilled water the surface no longer gives the normal electric potential when we lead off from a spot in contact with 0.01 M KCl to one in contact with 0.01 M NaCl. The simplest explanation is that an organic substance, which we may call *R*, is dissolved out of the surface by distilled water, and this takes place more rapidly in the presence of acid or of alkali but more slowly in the presence of calcium. At certain times of year *R* is apparently produced more slowly than it is dissolved out by the pond water, for the cells lose their irritability. Apparently *R* is stored in the vacuole, and when cells have lost their irritability, pressure, which forces sap from the vacuole into the surface, can restore irritability and the normal behavior toward potassium. It seems possible that other cases of anesthesia may be due to the fact that substances are removed from the cell.

A genetic factor for localization of tobacco-mosaic virus in Capsicum: FRANCIS O. HOLMES (introduced by L. O. Kunkel). Most common varieties of the garden pepper, *Capsicum frutescens* L., when inoculated with tobacco-mosaic virus, develop a systemic infection with resultant stunting, production of mottled leaves and reduction of yield of fruits. A few varieties, although equally susceptible to infection, localize the virus in or near necrotic lesions at the site of inoculation, thus preventing development of systemic infection; these varieties soon free themselves from virus by abscission of affected leaves and subsequently grow as healthy plants. The Tabasco pepper is one of the latter type. The capacity to localize tobacco-mosaic virus has been shown by intervarietal crosses to be controlled by a single dominant factor. This factor is inherited in typical Mendelian fashion, and is not influenced by other factors or combinations of factors thus far observed. No morphological character of the plant has been found constantly associated with ability to localize the virus. This is the only known instance, in a plant, of a single genetic factor which prevents systemic spread of a virus. By hybridization it has been possible to develop peppers combining large size of fruit and some other desirable commercial qualities with immunity to systemic tobacco-mosaic disease.

On photosynthesis and free nitrogen fixation by leguminous plants: E. B. FRED and P. W. WILSON. Recent quantitative studies on the biochemistry of nitrogen fixation emphasize the intimate relationship between carbohydrate synthesis and nitrogen fixation. Such experiments reveal an integration of the functions of the plant and bacteria which are not brought out by qualitative studies. To investigate the biochemistry of this problem experiments of a quantitative nature were made to discover the factors which control the process. The carbohydrate-nitrogen relation in the biological system consisting of plant and nodule bacteria was varied in four distinct ways: First, the carbohydrate supply was increased by growing the plants in an atmosphere rich in CO_2; second, the quantity of nitrogen fixed was de-

creased by growing the plants in an atmosphere of low nitrogen tension; third, the carbohydrate content was varied through a wide range by growing the plants in atmospheres of differing oxygen tensions; fourth, the nitrogen tension in relation to the available carbohydrate was varied by the addition of combined nitrogen in the presence and absence of added CO_2. The results of all these studies were consistent and showed that the carbohydrate-nitrogen relationship is an extremely important although not the only factor in the various functions of symbiotic nitrogen fixation. The significant conclusions of these studies may be summarized as follows: First, under natural conditions, in the presence of suitable supply of inorganic plant food, carbohydrate synthesis is the limiting factor in the assimilation of free nitrogen. Second, any factor which increases the available carbohydrate in relation to the nitrogen present increases the number of nodules. Likewise, a decrease in the available carbohydrate will reduce the nodules. The effect may result in change in the size rather than the number of nodules. Third, an increase in carbohydrate is accompanied by the formation of nodules on the lateral roots of the plant. This fact suggests that the normal position of the nodules on or near the primary root is determined in part by the carbohydrate supply. Fourth, the retarding effect of combined nitrogen on the fixation process seems to be associated with the lowering of the carbohydrate level in the plant. The combined nitrogen reacts with carbohydrate to form complex nitrogen compounds and thus reduces the available carbohydrate. This results in the development of fewer and smaller nodules, as noted in other experiments in which the carbohydrate level was varied. If the carbohydrate level is raised, *e.g.*, supplying additional CO_2, the effects of combined nitrogen can be reduced.

Cellular oxidations—some phases of the respiratory activity of normal and blocked embryonic cells: JOSEPH HALL BODINE (introduced by C. E. Seashore). Intensive studies have been made of the oxygen consumption of normally developing and blocked (diapause) cells of the embryo of the common grasshopper (*Melanoplus differentialis*). By means of accurately controlled experimental conditions it has been possible to make extremely close correlations between the morphological and physiological activities of embryonic cells throughout various phases of activity as well as during periods of developmental block or diapause. The effects of different tensions of oxygen and carbon monoxide as well as the action of cyanides and loss of water have been studied. Marked differences in response to these reagents are found for the embryonic cell when actively developing, as compared with the same cell during periods of rest or developmental block. The resting or blocked embryonic cell appears to react as a very sensitive type of cell, while the actively developing one is usually markedly inhibited in its activities. An analysis of the oxidative mechanisms concerned in reactions of the embryonic cell in the active and blocked condition is given.

Ontogeny and phylogeny of man's appendages: CHARLES B. DAVENPORT. The human appendages, like those of the lower mammals, begin their development as four buds on the sides of the body between neck and base of tail. Very soon differentiation appears. The arms at first grow a little more rapidly than the legs, but some time before birth the latter surpass the former. A curve showing the changes in the relation in these two appendages is given. In the anterior appendage the segments at birth, in humans, are nearly equal, but in later life the upper segment becomes greater than the lower segment. Similar change takes place in the segments of the legs. The relation in length of the appendages to each other and of the segments to each other in each appendage are adaptive for man, as an organism that stands erect and uses his arms to handle tools. The proportions have, however, a phylogenetic significance, for in other mammals that stand erect, like the kangaroo and certain jumping mice, the anterior appendages are greatly reduced in size from that found in their close relatives that walk upon the surface of the ground instead of jumping. Such reduction in the arms would be highly disadvantageous for man not as a walking animal but as one that uses his arms to handle tools. We may say that it is fortunate that man was derived from arboreal ancestors whose long arms were necessary to living in trees. The relative shortening of arms in relation to the terrestrial locomotion of man in his upright position has not been disadvantageous, because the reduction from the primitive long arms has only left a length suitable for the purposes for which man employs his arms as a tool user.

The life history of an anatomical feature: ALEŠ HRDLIČKA. The growth of the anthropological and primate collections in this country is beginning to permit what hitherto has been impossible to either anatomy or anthropology. This is the study of the entire life history, together with a large part of the racial, sex and individual variation, of individual morphological features. This applies particularly to the features presented by the skull and the skeleton, the collections of human brains and soft organs being still far from adequate for such purposes. By a "life-history" of a feature is meant the evidence showing its incidence, development and growth throughout life and its eventual fate during senility. For such a study it is indispensable to have adequate materials from all stages of existence, and here is where the great difficulty of obtaining juvenile and adolescent remains in sufficient normalcy and numbers has up to recently offered a serious obstacle. Such collections however were eventually realized with other races than the whites and are proving of great value. The life-history presented in this communication is that of one of the most interesting features of the human thighbone —namely, the so-called hypotrochanteric fossa. This hollow, a survival from our pre-human ancestry, begins to appear occasionally during the fifth month of the fetal life. After that it manifests its first great peculiarity. Instead of finishing its appearance within a reasonable time it keeps on originating in diverse femora throughout the entire human growth period, or at least so until late adolescence, when, in diverse human groups, it has become almost universal and has reached its opti-

mum development. And then, though not seldom even before, there sets in a gradual regression, through the encroachment upon the fossa of the neighboring ridge which gives attachment to the gluteus maximus. In the large anthropoid apes the fossa itself had evidently served for the attachment of this muscle, while the gluteal ridge remained quite secondary. In the human subject the attachment has shifted to the ridge and the fossa apparently became "obsolete." As a phylogenetic feature of probably long duration it still appears in man and develops, though the period of appearance has been greatly lengthened and in many instances the development of the hollow itself has suffered. But when the gluteal ridge reaches the need of expansion (through increased activity of the muscle) the fossa is encroached upon, there take place within it secondary deposits of bone and this new bone, which in instances comes to fill the whole fossa or to leave but a trace of the same, coalesces eventually with the gluteal ridge. Thus terminates the highly interesting life-history of the hollow under consideration. The observations that permitted this survey of the life history of an anatomical feature involved roughly ten thousand human femurs of all ages. The detailed results will be published by the Smithsonian Institution.

Senescent hypotheses as to the nature and causes of evolution: HENRY FAIRFIELD OSBORN. Biology at present can not be ranked with physics or chemistry as a branch of science. We await the arrival of a master mind which can synthesize the generalizations and inductions now being made in widely separate fields of research. The facts are multiplying at an enormous rate and from these facts hasty inductions are being made which are more or less biased by preconceptions in the mind of the observer, also by the special field of research in which the observations have been made. Among the host of facts which are wholly uninterpretable at present it is only natural for us to seek for interpretation or to try to fit the facts into the more or less senescent hypotheses as to the nature and causes of evolution. Despite Huxley's warning that science commits suicide when it adopts a creed we find many observers still strongly influenced by ancient scientific creeds. To my knowledge the most ancient is the "chance" hypothesis which dates back to Empedocles of Agrigentum and is still entertained by such modernists as T. H. Morgan and J. B. S. Haldane. There is a general failure to distinguish between Darwin's positive demonstration of the selection of the fittest combinations of energy which we observe in organisms, and the origin of a single organ or of a single species through the selection of variations which in any sense of the word could be designated as "chance." The next in age is the Lamarckian creed, which extends at least from its expression by Aristotle down to the modernists, McDougall and Kammerer; this creed, first assailed by Weismann in 1880, is now in a moribund condition; like the "chance" creed there is amassed overwhelming evidence against Lamarckism. Much less senescent and in a much more healthy condition at present is the doctrine of the direct action of environment not only upon the organism but upon the geneplasm. It seems fair to connect this creed of direct environmental action with the names of Buffon and Geoffroy St. Hilaire, because these distinguished Frenchmen of the eighteenth and beginning of the nineteenth centuries were the first to formulate the theory of environmental action and to adopt it. It now seems to be well established that one of the direct causes of the origin of species is the gradual and inherited modification of the geneplasm by the forces of the environment. The fourth creed is that of an internal perfecting principle or "entelechy," which originated in a misunderstanding of Aristotle's very sound inductions of an internal principle governing evolution and reappeared in the "neovitalism" of Driesch and the *élan vital* of Bergson. This, too, is a creed which does not bear the crucial test of observation. In concrete observation and researches of the past quarter century it has been positively demonstrated that there are two entirely distinct principles in evolution—the second principle applies to development which is quantitative or intensive, and to such development new applications of the selection principle of Darwin and the indirect influences of environment and habit of Buffon and Lamarck more or less distinctly apply. Entirely apart from this is the first principle of evolution which embraces the origin of entirely new characters. Such origins have thus far only been demonstrated positively in a limited number of characters, but there is the inevitable inference that this originative or creative principle will ultimately extend to a much larger number of characters. If it does it will inevitably revolutionize our whole biological philosophy. In the meantime let us quietly drop all these senescent hypotheses as to the nature and causes of evolution and make a wholly fresh start along entirely new and original lines of observation and experiment, directed toward the discovery of the now wholly unknown factors in this most mysterious of natural phenomena.

A method for observing the solar corona without an eclipse: A. M. SKELLETT (introduced by Herbert E. Ives). The problem of viewing the solar corona at times other than those of eclipses has not as yet found adequate solution. The reason is that the brightness of the glare around the solar disk, due to atmospheric and telescopic scattering, is many times the brightness of the corona. Excellent progress in reducing such glare by photographic methods has been made recently by Lyot (*Compt. Rend.* 195, 21, 1932). His results, however, serve to emphasize the need of a method which will give greater discrimination. The mechanism of present television technique appears to offer a solution to this problem. The proposed method is as follows: The image of the sky around the sun's disk is to be scanned by a small hole behind which a photoelectric cell is placed. The resulting photoelectric current will be made up of high frequency components, due to the details of the coronal image and a relatively large direct current component plus some low frequency components due to the glare. These various components will then be separated by appropriate electrical filters, and only those due to the corona will be amplified and used in the television receiver for the reproduced image.

It should thus be possible to reproduce the major features of a solar eclipse at any time when the sky is clear. Tests, covering the essential features of this proposal, have been made with laboratory television apparatus. It has been found possible to flood the photoelectric cell with steady light of several thousand times the intensity of the primary image before reaching the level at which electrical noise interferes seriously with the quality of the image. These tests, considered in the light of the known brightness of the sky relative to the corona, show that the method should be adequate. A necessary condition is that the scanning method must be substantially free from any features which can introduce high frequency components, such, for instance, as those due to mechanical masking of the scanned field. It is believed that these requirements can be satisfactorily met. The use of such technique for image discrimination, particularly to increase contrast, is not, of course, necessarily limited to the specific application mentioned above.

An application of the photoelectric amplifier to the photometry of faint stars and nebulae: JOEL STEBBINS and ALBERT E. WHITFORD. The combination of a photoelectric cell and a vacuum tube make a sensitive and useful device for the measurement of the light and colors of stars. This instrument, called the photoelectric amplifier, was perfected at the Washburn Observatory of the University of Wisconsin. It has been used on a 15-inch telescope, and last summer it was installed on the 100-inch reflector at Mount Wilson, Calif. Experiments at Madison showed that the amplifier, even without a telescope, was sensitive enough to detect an ordinary candle set up at the distance of one mile. In fact, the instrument will indicate about a one-thousandth part of the light of a candle at that distance, or a full candle at thirty miles, where it would be quite invisible to the eye. On the 100-inch telescope the amplifier would detect a candle at three thousand miles. As used at Mount Wilson the new instrument has proved capable of measuring faint luminosity in the sky beyond the range of the photographic plate; it also will give more precise measures of the colors of stars than can be made either by the eye or by photography. Previous measures of the colors of faint stars and clusters of stars with the photoelectric cell had confirmed the presence of quantities of dust between the stars, revealed by the reddening effect on the light of distant objects seen through the dust, just as the sun appears reddened when we see it through a great amount of air at sunset. The improved amplifier has extended the distance over which this interstellar dust can be studied. In the direction of the center of the galaxy, the system of stars to which the sun belongs, the stars increase in redness in proportion to their distance, but in the opposite direction, away from the center, there is a limit to the reddening and we seem to see out where the dust is much thinner. Simply by measuring the colors of stars around the Milky Way we can tell that we must be at one side of the system; the stars are redder toward the summer constellation of Sagittarius than toward the winter constellations of Orion and Taurus. In two ways the amplifier, or so-called electric eye, has enabled us to see better our own position in space. The other galaxies, like the nebula in Andromeda, are shown to be larger than was supposed, and the calculated dimensions of the Milky Way system come out smaller when allowance is made for the obscuring effect of the dust between the stars. Our own galaxy may still be the largest one in sight, but it is not so great and important as we thought.

Studies of weather periodicities: C. G. ABBOT. Author describes the method he employs to discover and evaluate periodicities in a complex curve of observation, and shows by a test analysis of an unknown complex curve prepared by an assistant that periodicities may be closely evaluated thereby. Seeks whether seven periodicities discovered in solar variation 1920–1932 exist in weather records of past century. Since his own and Clayton's studies show that periodicities in weather are subject to large changes in phase when solar activity changes, author restricts the computations to epochs when the Wolf sunspot numbers were below 30. Results show that for several stations the solar periods assumed, 7, 8, 11, 21, 25, 46 and 69 months, give evidence of persisting for nearly a century in weather records, often with individual amplitudes of from one to two degrees F. in temperatures. Slow progressive changes of phase, however, indicate slight corrections to the length of the assumed periods. Applying these corrections, an approximate least common multiple of all these seven periodicities is found as follows:

Corrected period	$7^{mo}0^{d}$	$8^{mo}0.5^{d}$	$11^{mo}5^{d}$	$21^{mo}0^{d}$	$24^{mo}25.5^{d}$	$45^{mo}0^{d}$	$68^{mo}0^{d}$
Number	39 mo.	34 mo.	24 mo.	13 mo.	11 mo.	6 mo.	4 mo.
Product	273.0	272.6	268.0	273.0	273.2	270.0	272.0

Thus in about 272 months, or 22 years, 8 months, all these periodic tendencies return nearly to the same phase. Inasmuch as this interval is almost exactly double the length of the well-known sun-spot period, it is apparent that relative phase changes attending alterations of solar activity should nearly disappear at times 22 years, 8 months separated. Expecting, therefore, that weather data should tend to show similarity when plotted in 23-year intervals, author has obtained such plots of departures from normal temperature and from normal percentage precipitation for numerous stations throughout the world. Considerable similarity is often found, but frequently it is subject to displacements of several months, and is obscured also by differences of amplitude of the features. Similar plots of thickness of clay varves of glacial age, thickness of tree rings of the past century and level of the Great Lakes during the last century also indicate recurrences of features at approximate 23-year intervals. Test forecasts of weather progress one year in advance have been made for numerous stations from 1922 to 1930 and compared with actual data. The results seem to show such considerable correspondence as to raise the hope that such forecasts may be of value for future weather forecasting.

On the implications of a variable velocity of light: P. I. WOLD (introduced by F. K. Richtmyer). In a recent meeting of the American Physical Society a speculation was conducted on the implications of the velocity of light being a function of time, but not of position, throughout space. The speculation was found to lead to a very simple explanation of the redward shift of spectral lines from nebulae. It was shown that if the velocity of light is taken as $C_t = C\ (1 - \alpha t)$, the redward shift reported by Hubble and Humason would be accounted for by a value of $\alpha = 5.72 \times 10^{-10}$, with the year as unit of time. The speculation has now been carried further and yields an apparent "photon leak," as has been desired by some in connection with the redward shift. The consideration also leads to the conclusion that in a space in which the velocity changes as a function of time the energy of a given photon changes with the velocity; the momentum of the photon remains constant; the radiation density for a volume traveling with the wave remains constant and the number of photons passing an observer remains constant. The last item is hard to reconcile with any present picture of the nature of the photon.

Interpretation of data from world cosmic ray survey: ARTHUR H. COMPTON. Data collected during the past two years by our associated expeditions under the auspices of the Carnegie Institution have established the existence of variations of cosmic ray intensity with geographic position, correlated closely but not exactly with the latitude relative to the earth's mean magnetic poles. These variations are much more prominent at high altitudes, where they extend also over a wider latitude range. These findings are shown to require the presence in the cosmic rays of electrified particles coming nearly uniformly from all directions far outside the earth. Details of the latitude effect suggest that these particles are positively charged, a conclusion established by directional experiments stimulated by the results of this survey. Analysis of the high altitude intensity measurements made as a part of the survey seems to show that the rays capable of traversing the atmosphere consist chiefly of protons or positrons, but that in the upper atmosphere rays of another type exist, which may well be heavier atomic nuclei. Comparison of absorption and transition effects at different latitudes shows that most of the rays reaching the earth are of approximately the same type, presumably protons or positrons or both. The energy spectrum of these rays in remote space must extend at least from 2×10^9 to 4×10^{10} volts, and probably over a much wider range. No evidence is found for either photons or electrons in the cosmic rays as they enter the earth's atmosphere. Relatively low energy photons may, however, constitute part of the absorbable cosmic rays observed in the upper atmosphere or high energy photons part of the relatively weak component of very penetrating cosmic rays which is prominent at great depths. The latter component may also consist in part of electrons, as far as these experiments are concerned.

The third major mechanical factor in the circulation of the blood: YANDELL HENDERSON, A. W. OUGHTERSON, L. A. GREENBERG and C. P. SEARLE. To be printed in SCIENCE.

Surface temperature and radiation of heat from the human body: EUGENE F. DU BOIS and JAMES D. HARDY. The human body loses more than half of its heat by radiation. It has been found that the white human skin acts as an almost perfect black body radiator. This makes it possible to determine the surface temperature of the skin by measuring the radiation. An instrument for this purpose has been devised which is sensitive, rapid, rugged and accurate. It consists of a small receiving disk of four thermocouples with four cold junction units in the immediate neighborhood but not exposed to radiation. The measurements are made in about ten seconds by placing the radiometer close to the skin but not in contact with it. The instrument is calibrated by means of a Leslie cube at temperatures the same as those of the skin. Tests of contact surface thermometers have shown that all of them are influenced by the air temperature. Measurements have been made of the surface temperatures of a number of normal subjects and of patients with various diseases. It has been found that under standard conditions the temperatures of different individuals are surprisingly uniform. The study of the chills of malarial fever shows that large amounts of heat may be stored in the body for short periods without affecting either rectal or surface temperature. The heat lost in radiation from the surface has been measured in connection with respiration calorimeter experiments and it is estimated that radiation contributes, under the standard conditions employed, approximately 65 per cent. of the total heat loss. Vaporization accounts for about 20 to 30 per cent. and convection for about 10 per cent.

The potentialities of extreme old age: FRANCIS G. BENEDICT and HOWARD F. ROOT. Hospital records are full of information with regard to the pathology and disintegrations of old age. Physiological studies of those who are hale and hearty are relatively rare. Such studies indicate the potentialities or possibilities of health and vigor in extreme old age. Observations were made on a man 91 years of age, with extraordinary physical and mental preservation. A study of the medical history is presented, with an attempted analysis of the factors contributing to this superior mental and physical state, or what may be termed "ideal" old age. With a family history conspicuous for the absence of arteriosclerotic diseases, with exemplary habits of life with regard to food, drink and matters of hygiene and, above all, with a philosophy doing away with worrying, this man has passed, good and strong, fourscore and eleven years.

Source and mode of infection in poliomyelitis: SIMON FLEXNER. At the meeting of the National Academy of Sciences held in November, 1933, I reported on the nerve path of infection in poliomyelitis. The present report is intended to complete the evidence for the sole transport

of the virus of the disease to the brain and spinal cord in man by way of the olfactory nerves. Two other modes of infection have been held possible. Levaditi, at the Pasteur Institute in Paris, emphasizes the alimentary tract as the portal of entry of the virus, and concomitantly Kling of Stockholm regards the epidemic disease as being water-borne in nature. The other possibility is that of a lower animal carrier of the virus, without the animal itself suffering the disease, but communicating it to human subjects. The 1931 and 1933 epidemics of poliomyelitis in New York City and State permitted a reinvestigation of these two possibilities. Earlier studies of the alimentary portal and of domestic animal carriers of the virus had given mainly negative results. But during the past few years improved, more delicate and certain methods of detecting the virus have been secured. These methods were applied in the new investigations. The intestinal mucous membrane and the adjacent mesenteric lymph nodes obtained from fatal cases of poliomyelitis were inoculated, under suitable conditions, into monkeys. In no instance was the presence of the virus detected, although the spinal cords taken from the same subjects proved infectious. *Macacus cynomolgus* monkeys were fed large amounts of the virus. This species was employed for the feeding experiment, since Levaditi succeeded with it, while he failed with the closely related *Macacus rhesus*, which is subject to infection by way of the nasal route. In our hands, the two species behaved in an identical manner—neither became paralyzed, and both quickly eliminated or destroyed the virus introduced in large quantities by stomach tube. Our experiments were carried a step beyond those previously made. Individual differences in response or susceptibility to the virus have been observed in the Macacus monkeys. Hence it was desirable to test the reaction of the cynomolgi, which resist the feeding, to the nasal instillation of virus. The resistant monkeys proved highly sensitive to these instillations, developing the experimental form of poliomyelitis in the same manner as the control animals. The feeding of virus neither leads to infection nor confers immunity, and individual susceptibility was shown to play no part in the failure of the feeding tests. Ordinary domestic, pet animals can not be infected with the virus of poliomyelitis; when inoculated, they spontaneously free themselves of the virus in a few days, by internal destruction. The wild animals which commonly live in close association with man in ordinary circumstances are rats and mice. These animals were trapped in regions in which poliomyelitis was epidemic, and their organs examined for the presence of virus. None was found. The captured animals were in part injected with virus, in order to determine the ability of the virus to survive in them. Human virus, as well as monkey passage strains, was employed for inoculation. It was thought possible that the strain existing in human spinal cord might prove better adapted to survival than the strains which had been altered somewhat by monkey passages. But neither virus survived beyond a few days. The results of this experimental study may be summed up as follows: The virus of poliomyelitis is highly neurotropic and finds in the exposed olfactory nervous structures in the nasal membrane a means, apparently the sole means, of entering the central nervous system directly. It is incapable of penetrating the mucous membrane of the alimentary tract, just as it is incapable of penetrating the intact skin. The virus can be made to pass to the spinal cord when inoculated in such a manner as to bring it into intimate relationship with usual nerve endings and fibers; but this inoculation does not reproduce the conditions under which infection with the virus ordinarily occurs in man. The evidence is strong that the virus is confined to the human host, and passes from individual to individual in the secretions of the nose and throat. Lower animals living in proximity to man do not act as healthy carriers and accidental transmitters of the virus to human subjects.

On the natural widths of the L-series x-ray spectrum of gold: F. K. RICHTMYER and S. W. BARNES. Much of our knowledge of spectra has been derived from measurements of the wave-lengths of the several spectral lines. It is generally recognized, however, that data both on the intensities and on the shapes and widths of lines are necessary to a complete understanding of the mechanism of radiation. The present paper reports measurements on the shapes and natural widths of 23 lines in the L-series spectrum of Au(79), determined by use of the two-crystal x-ray spectrometer. To get the true widths, W_n, from the observed widths, W_o, (full widths at half maximum) we have used the following empirical formula: $W_n = W_o - W_R/2$, where W_R is the width of the rocking curve in the (1, −1) position of the crystals. This formula is qualitatively consistent with the observed shapes of lines (1, +1 position) and rocking curves (1, −1 position) for the wave-length range covered in this work. The correction is of the order of a few per cent. Additional confidence in the validity of this method of correction is obtained by applying it to the data reported by Williams (*Phys. Rev.* 45: 71, 1934), whose crystals gave (1, −1) rocking curves some 30 per cent. narrower than ours. When so corrected, the widths of three of the four L lines of Au(79) reported by Williams agree with corresponding lines herein reported by better than 1 per cent., data on the fourth of his lines being not comparable with ours. The natural widths of the several lines of the L-series of Au(79) vary from 0.53 X.U. for $L\gamma_6$ to 3.41 X.U. for Ll.

"Appearance" of atoms as observed with x-rays: ARTHUR H. COMPTON and E. O. WOLLAN. Photographs are shown which are the images of atoms of helium, neon and argon as obtained by x-ray diffraction, magnified about 2×10^8 times on the lantern slide. The images are obtained by photographing a rotating template whose shape is calculated by a mathematical transformation of our measured values of the x-rays scattered by the respective gases. This mathematical-mechanical procedure corresponds to the lens which forms the image when a microscope is used. The images formed by our procedure should be true representations of the electron distributions in the atom, except for the limited resolving power

and certain minor aberrations. The photographs show the helium atom as a diffusely continuous region filled with electricity. In neon, the inner group of K electrons is clearly distinguishable from the L electron group. The resolving power is insufficient to distinguish the K and L groups of electrons in argon, but does separate these from the M electrons. The appearance of these atoms is in good accord with modern quantum theory of atomic structure. These experiments afford probably the most direct information now available regarding the way in which electrons are distributed in atoms.

(To be concluded)

SCIENTIFIC EVENTS

THE BRITISH ASSOCIATION OF SCIENTIFIC WORKERS[1]

THE annual report of the Executive Committee of the Association of Scientific Workers presented to the council on February 24 refers to the formation of a National Parliamentary Science Committee as an outcome of negotiations with the British Science Guild as the outstanding special work of the year. The support of twelve leading institutions has been obtained, and the committee includes Sir James Henderson, Professor Miles Walker, Professor Blackman, with Commander Bernacchi as chairman, and Mr. A. Howard and Mr. H. J. W. Stone as joint honorary secretaries. In consequence, the Parliamentary Committee of the British Science Guild and of the Association have been disbanded. The compilation of a "Handbook of Extra-University Research in Pure and Applied Science," giving data concerning commercial, endowed and private research laboratories, has been completed and negotiations for publication are in progress. It is believed that the handbook will serve as an advertisement of British research activities and of the interest taken by British industrialists in maintaining the highest efficiency in factories. The book may become a standard work of reference alongside the "Universities Yearbook" and the "Year-Book of Scientific and Learned Societies."

The association has been active in combating the evil of bogus degrees and has been in negotiation with the universities to secure their support of successive bills introduced in the House of Lords by Lord Jessel to deal with this evil. The association collected a considerable amount of information regarding the granting of degrees by five different British "degree-mongers" but has so far been unable to induce the universities to withdraw their opposition at the third reading of the bills. The finance of the research associations has received attention and is being considered by a joint Committee of the Association and the British Science Guild. The production of "Science in Parliament" has continued and a memorandum has also been prepared on the relation of the unification of national transport, the construction of ship-canals across Britain, the reconstruction of derelict canals and land-drainage. The report concludes by directing attention to the resolution passed that members should seek to assist towards a better adjustment between scientific advances and social progress.

[1] From *Nature*.

THE U. S. BUREAU OF STANDARDS

AT the recent meeting of the American Chemical Society, a resolution was passed urging increased financial support by the Federal Government for the U. S. Bureau of Standards. The resolution reads:

The establishment and maintenance of certain fundamental standards are vital to the advancement of the science of chemistry.

These standards have been established and maintained by the Bureau of Standards under the authority of Congress for many years, and new standards are developed by the bureau as need is found for them.

The bureau is performing its proper functions in an expanding national and international program. This work conforms to the original purpose for which the bureau was established, and has been done so well as to gain it national and international favor and reputation.

The American Chemical Society, an organization of 17,000 members practising their profession in the scientific, academic and industrial fields, believes this work to be of great scientific value, and necessary to practical advances in both pure and applied chemistry.

As a consequence of the retrenchment policy of the Federal Government, the continuance of these activities of the Bureau of Standards has been put in jeopardy.

The attention of proper committees and members of Congress is called to this critical situation with the request that, in making appropriations, provision be made for the necessary and adequate standardization and research activities of the Bureau of Standards, so that it may continue its valuable service to chemical science and industry.

A PALEONTOLOGICAL RESEARCH INSTITUTION AT ITHACA, N. Y.

DURING the past few decades considerable Neozoic material has been collected and brought to Ithaca, N. Y., for study by paleontological students. Bulletins of American paleontology have offered a ready means for publishing descriptions and illustrations of this new material. It relates largely to the Southern States, West Indies and South America with con-

siderable European collections. Facilities for the conserving of types have been hitherto lacking here; hence a fireproof building has been privately constructed and deeded to this institution (incorporated under the Board of Regents of the State of New York on October 12, 1933). The bulletins become the official organ for the institution, and all editions of the same, together with rare paleontological publications and type specimens, are housed in the building now erected. The board of trustees (seven in number) consists largely of local paleontological workers. Suitable equipments are now assembling.

There are three leading ideas underlying the establishment of this institution:

(1) To prevent the labor and valuable acquisitions of each generation from being wasted or lost, as is too frequently the case in educational institutions without proper museum facilities.

(2) To furnish temporary working facilities for paleontological students home from abroad or not connected with regular university or museum organizations.

(3) To serve as a regional center (since our country is large and not unicentric as is France) where local young students may see actual investigation going on and hence, perhaps, become interested in this branch of science.

It may perhaps be added that whenever there is need of consulting outside sources, few places are better surrounded by universities of rank—east, south, west and north—all within a day's auto journey, than Ithaca. G. D. HARRIS

THE AMERICAN PHILOSOPHICAL SOCIETY

AT the annual meeting of the American Philosophical Society held in Philadelphia on April 19, 20 and 21, the following members were elected:

Dr. Detlev W. Bronk, professor of biophysics at the University of Pennsylvania and director of the Eldridge R. Johnson Foundation for Research in Medical Physics.

Dr. Willa Cather, New York, N. Y., novelist.

Gustavus Wynne Cook, Wynnewood, Pennsylvania, president of the South Chester Tube Company.

Dr. Wilbur L. Cross, New Haven, governor of Connecticut.

Dr. Cass Gilbert, New York, N. Y., architect.

Dr. Edward S. Harkness, New York, N. Y., railroad executive.

Horace Howard Furness Jayne, director of the University of Pennsylvania Museum.

Dr. Alfred Vincent Kidder, Andover, Massachusetts, chairman of the Division of Historical Sciences of the Carnegie Institution of Washington.

Dr. John Livingston Lowes, professor of English, Harvard University.

Dr. Frederick G. Novy, professor of bacteriology and director of the Hygienic Laboratory of the University of Michigan.

Dr. Conyers Read, professor of English history, University of Pennsylvania.

Dr. Jesse S. Reeves, William W. Cook professor of American institutions and chairman of the department of political science, University of Michigan.

Owen J. Roberts, Washington, D. C., associate justice of the United States Supreme Court.

Dr. George Sarton, lecturer on the History of Science, Harvard University, and editor of *Isis*.

Dr. Deems Taylor, New York, N. Y., musician.

Roland S. Morris, of Philadelphia, was reelected president, and Dr. Robert A. Millikan, of the California Institute of Technology, was elected a vice-president. Vice-presidents reelected were Dr. Edwin G. Conklin, of Princeton University, and Alba B. Johnson, of Philadelphia. Dr. Albert P. Brubaker is curator and Dr. Arthur W. Goodspeed and Dr. John A. Miller are the secretaries. The Rev. Dr. James A. Montgomery, graduate professor of Hebrew and Aramaic at the University of Pennsylvania, succeeded as councilor Dr. Cyrus Adler, president of Dropsie College. Other councilors, reelected, are Dr. Charles G. Abbot, of the Smithsonian Institution; John Cadwalader, of Philadelphia, and Dr. Hugh S. Taylor, of Princeton University.

RECENT DEATHS

DR. ISAAC JOACHIM SCHWATT, emeritus professor of mathematics at the University of Pennsylvania, died on April 18, in his sixty-seventh year.

CLEVELAND ABBE, JR., editor of the publications of the department of chemistry at Cornell University, died on April 19 at the age of sixty-two years.

CHARLES WRIGHT DODGE, for forty years and until his retirement as professor emeritus in 1931 professor of biology at the University of Rochester, died on April 17 in his seventy-second year.

DR. HENRY DONALD CAMPBELL, for forty-seven years on the faculty of Washington and Lee University, and dean for twenty-six years, died on April 10 in his seventy-second year.

F. PAUL ANDERSON, heating and ventilating engineer, since 1917 dean of the College of Engineering at the University of Kentucky, died on April 8, at the age of sixty-seven years.

DR. OSKAR VON MILLER, founder of the Deutsches Museum at Munich, died on April 9 at the age of seventy-eight years.

SCIENTIFIC NOTES AND NEWS

DR. ROBERT G. AITKEN, director of the Lick Observatory, was presented with honorary membership at a meeting of the Rittenhouse Astronomical Society at the Franklin Institute on April 19. On this occasion Dr. Aitken gave an address, taking as his subject "The Work of a Mountain Observatory."

AT a meeting of the New York Mineralogical Club at the American Museum of Natural History on Saturday, April 28, a reception and testimonial will be presented to Dr. Edward Salisbury Dana, professor emeritus at Yale University, in recognition of his acceptance of honorary membership in the club.

ACCORDING to a press dispatch, at a banquet tendered in honor of the delegates at the close of the Ninth International Congress of Pure and Applied Chemistry, at Madrid, Dr. Atherton Seidell, chemist, of the National Institute of Health, U. S. Public Health Service, was made by the Spanish government a commander of the Order of the Republic.

A CERTIFICATE of honorary membership in The American Ceramic Society, awarded to Professor Henry Le Chatelier, by the fellows of the society at the annual convention held in Cincinnati in February, was presented to him in Paris on April 16 by Dr. Alexander Silverman, head of the department of chemistry at the University of Pittsburgh.

AT a meeting and dinner of the American Institute, which will be held at the American Museum of Natural History, New York City, on May 3, gold medals will be presented to Dr. Oscar Riddle, research associate, Carnegie Institution at Cold Spring Harbor, L. I., in recognition of his achievements in endocrine research, and to Dr. E. V. McCollum, head of the department of biochemistry of the School of Hygiene and Public Health of the Johns Hopkins University, in recognition of his work on nutrition. The presentation to Professor McCollum will be made by Dr. H. C. Sherman, of the department of chemistry of Columbia University, and to Dr. Riddle, by Dr. Allan Winter Rowe, director of research at the Evans Memorial Hospital, Boston.

DR. GEORGE R. MINOT, professor of medicine at the Harvard Medical School, has been elected an honorary fellow of the Chicago Institute of Medicine.

PROFESSOR R. D. CARMICHAEL, of the department of physics of the University of Illinois, has been made dean of the Graduate School and Dr. M. T. McClure, professor of philosophy, dean of the College of Liberal Arts and Sciences. Dr. Carmichael and Dr. McClure have served as acting deans during the present academic year.

AT the Massachusetts Institute of Technology, Professor Charles Blaney Breed has been promoted to be head of the department of civil and sanitary engineering, and Professor Henry B. Phillips has been appointed acting head of the department of mathematics, succeeding Professor Frederick S. Woods, who will retire next fall. The following promotions to full professorships have been made: Dr. Arthur C. Hardy, of the department of physics; Dr. George Rutledge, of the department of mathematics, and Dr. Walter C. Schumb, of the department of chemistry.

DR. JOHN HASBROUCK VAN VLECK, professor of physics at the University of Wisconsin, has been elected associate professor of mathematics and physics at Harvard University. Alfred Rehder, curator of the herbarium of the Arnold Arboretum since 1918, has been elected associate professor of dendrology.

The British Medical Journal notes the following appointments: Dr. Richard Sirbeck, of Heidelberg, professor of internal medicine at Berlin; Dr. Aubertin, professor of experimental medicine at Bordeaux; Dr. Serr, professor of medical pathology at Toulouse; Dr. Ladislas Melanowski, professor of ophthalmology at Warsaw, and Dr. E. Cylarz, professor of internal medicine at Vienna in succession to Professor J. Pal.

THE Society for Experimental Biology and Medicine have elected the following officers: *President,* E. L. Opie; *Vice-president,* P. E. Smith; *Secretary-Treasurer,* A. J. Goldforb; *Councillors,* E. F. DuBois, H. W. Smith; *Nominating Committee,* P. Rous, *chairman,* E. Allen, A. J. Carlson, A. R. Dochez, E. A. Doisy, R. Gesell, A. C. Ivy, J. R. Murlin and O. Riddle.

AT the annual business meeting of the Western Reserve University Chapter of the Society of the Sigma Xi the following officers were elected for the year 1934-1935: *President,* Dr. James A. Doull, professor of public health; *Vice-president,* Dr. J. Paul Visscher, professor of biology; *Secretary,* Dr. W. M. Krogman, associate professor of anatomy and physical anthropology; *Treasurer,* Dr. E. W. Skinner, associate professor of basic and dental technology. Drs. Carl J. Wiggers and H. S. Booth were elected to the membership committee for a three-year term. Following the business meeting the president-elect made an address on "The Present Status of Our Knowledge of Leprosy," illustrated with slides and a film on "A Day at the Clinic in Cordova, Cebu." As an additional feature the chapter was privileged to exhibit, through the courtesy of the Mallinckrodt Chemical Works, films on "The First Public Demonstration of Anesthesia" and on "The Manufacture of Anesthetic Ether."

DR. ANNA W. WILLIAMS, since 1905 assistant director of laboratories in the New York City Department of Health, of which Dr. William H. Park is director, was retired on March 23, having passed the

age limit for city employees. She will continue her research in the laboratories on a pension.

FRANÇOIS E. MATTHES, of the United States Geological Survey, has been appointed "titular member," representing the United States, of the Commission Glaciologique of the International Geodetic and Geophysical Union. He was reappointed recently as chairman of the Committee on Glaciers of the American Geophysical Union for a second term of three years.

DR. ARTHUR BEVAN, state geologist of Virginia, has been elected secretary of the Association of American State Geologists and editor of the quarterly journal published by the association.

DR. E. M. NELSON, of the Bureau of Chemistry and Soils, U. S. Department of Agriculture, has been invited to represent the United States as one of two official delegates at the second International Conference on Vitamin Standardization to be held in London, from June 12 to 14, by the Health Organization of the League of Nations.

DR. O. LARSELL, professor of anatomy at the Medical School of the University of Oregon, and Dr. A. R. Moore, at present a visiting professor at the Tohoku Imperial University of Sendai, Japan, will be laboratory guests at the Morris Biological Farm of the Wistar Institute, Philadelphia, during the coming summer.

DR. HERBERT H. WHETZEL, professor of plant pathology at Cornell University, left on April 21, on a collecting trip to procure specimens of a rare cup fungus. His trip will lead him through the Canadian province of Manitoba. On his return Professor Whetzel will deliver two lectures at the University of Minnesota on "Coming—the Practising Plant Pathologist," and "Scholastic Freedom, or the Right to Learn."

DR. E. D. ADRIAN, Foulerton research professor of the Royal Society and fellow of Trinity College, Cambridge, has been appointed chairman of a new committee set up by the British Medical Research Council, in consultation with the Board of Control. The committee will advise and assist in the promotion of research into mental disorders. It will include representatives not only of psychiatry, medical psychology and the study of mental deficiency, but also of neurology, physiology, biochemistry, pathology and genetics.

DR. ARTHUR STANLEY EDDINGTON, Plumian professor of astronomy and director of the observatory at the University of Cambridge, will speak at a luncheon given in his honor by the English-Speaking Union of the United States, at the Astor Hotel on April 28. Dr. Eddington is Messenger lecturer for 1934 at Cornell University.

DR. EDWIN P. HUBBLE, of the Mt. Wilson Observatory, gave the evening lecture before the National Academy of Sciences on April 23. His subject was "The Realm of the Nebulae."

DR. JOHN F. FULTON, Sterling professor of physiology, Yale University, gave the tenth N. W. Jones lectures at the University of Oregon Medical School. His subjects were "Autonomic Representation in the Cerebral Cortex" and "The Functions of the Frontal Lobes."

DR. WILLIAM J. CROZIER, director of the laboratory of general physiology at Harvard University, discussed "Behavior and Mechanism" at a recent meeting at the American Museum of Natural History of the New York Association of Biology Teachers.

PROFESSOR H. LEVY, professor of mathematics at the Imperial College of Science and Technology, London, delivered the twenty-fifth Conway Memorial Lecture on April 25, his subject being "Science in an Irrational Society."

A GROUP of members of Sigma Xi residing in Kansas City and vicinity met on March 12 at the University of Kansas City and organized the Sigma Xi Club of Kansas City. On March 19 the first regular meeting was held with Dr. James E. Wildish, of Kansas City Junior College, delivering a paper on "Radioactive Families." Regular meetings will be held on the second Friday of each month.

APPLICATIONS for the positions in connection with the U. S. Geological Survey of chief topographic draftsman, principal topographic draftsman, senior topographic draftsman, topographic draftsman and assistant topographic draftsman must be on file with the U. S. Civil Service Commission at Washington, D. C., not later than May 22. The entrance salaries range from $1,620 to $2,600 a year subject to a deduction of not to exceed 10 per cent. until June 30, 1934, and of not to exceed 5 per cent. during the fiscal year ending June 30, 1935, as a measure of economy, and also to a deduction of 3½ per cent. toward a retirement annuity. Applicants must have had certain education and experience.

THE *Bulletin* of the Mount Desert Island Biological Laboratory for 1934 contains announcements for the coming season, reports of officers and abstracts of research accomplished during 1933. Those wishing to work at the laboratory during 1934 should apply before May 1 since accommodations are limited. Copies of the *Bulletin* may be secured by writing to Professor William H. Cole, Rutgers University, New Brunswick, New Jersey.

A CORRESPONDENT writes: "The Louisiana State University is opening its Field Laboratory at Grand Isle with good prospects. With the cooperation of

the State Conservation Commission and the resident staff in Baton Rouge in the departments of botany, zoology, geology and forestry it is felt that a good many investigations can at least be begun this summer by the students already enrolled. A number of independent investigators have joined the laboratory from other sections of the country in order to compare the Gulf fauna with Atlantic and Pacific coast fauna. As in previous summers, Dr. E. H. Behre, of the department of zoology, will be in charge."

IT is announced by the New York Academy of Medicine that a sum of approximately eight hundred dollars is available under the Edward M. Gibbs Memorial Prize during 1934. Candidates, who must be physicians who have been graduated at least three years and who are residents of the United States, shall submit "evidence of research already performed and of facilities to prosecute research upon the causation, pathology and new methods of treatment of diseases of the kidney." The award may be continued, but not more than three years to any one individual. Applications with the required evidence should be addressed to the New York Academy of Medicine, 2 East 103d Street, New York City, prior to June 1.

IT is announced that the authorities of the Naval Academy at Annapolis are making plans for a planetarium similar to the planetarium now under construction for the American Museum of Natural History, New York.

ACCORDING to *The Museum News*, a topographical survey of the area occupied by the National Arboretum at Washington has been authorized as a preliminary to completing plans for roads, trails and buildings. The survey is to be made by the Bureau of Plant Industry, which has received an allotment of $10,000 from the Public Works Administration for the purpose.

A NOTE in a recent issue reported the acquisition by the Museum of Anthropology of the University of Michigan of a collection of Indian basketry and bead work given in memory of Mrs. W. B. Hinsdale, who died in January of this year. Through an unfortunate error reference was made to the "late Dr. Hinsdale." Dr. Hinsdale is now professor emeritus of internal medicine and associate in charge of the Division of the Great Lakes in the Museum of Anthropology.

SIR JOHN RUSSELL, director of the Rothamsted Experimental Station at Harpenden, writes to the London *Times* in reference to the recent appeal for £30,000 for the purchase of the experimental fields in part as follows: "I am thankful to say that the appeal has been so well received that complete success is now possible if only the friends of Rothamsted will do a little more. Mr. Robert McDougall, of Cheadle, has offered £15,000, and the Halley Stewart Trust Fund has offered £5,000, towards the total sum required, but both have attached the entirely reasonable condition that the remaining £10,000 shall be raised before May 12, when our option expires. Sir Bernard Greenwell gave £1,000, and another £1,000 was secured through the help of old supporters of Rothamsted. A list of these will shortly be issued. The station is thus confronted with the problem of raising £8,000. Machinery has been set in motion for collecting from farmers and others living in country places. But the countryside, though very sympathetic and appreciative, is not well off, and for much of the £8,000 we shall be dependent on the generous help of public-spirited men and women who, while recognizing the importance of agriculture to the community, are not themselves actually farming."

FREDERICK S. DELLENBAUGH has recently completed for the Museum of the American Indian, Heye Foundation, New York, a painting 42″ x 60″ upright, as a record in color, on a large scale, of the stairway leading down towards the valley from the Hopi village of Walpi at the south end of the First Mesa, Arizona. This stairway of sandstone slabs was constructed centuries ago and is still intact. It is known as an excellent example of the ingenuity of the Hopi in the line of original, constructive building. On one side it is bounded by the upright cliff, on the other by a towering, monumental column of solid rock balanced, apparently rather precariously, giving somewhat the effect of the Leaning Tower of Pisa. The steps lead down for a couple of hundred feet through this picturesque setting. As it is probable that in the course of time the stairway will not be kept in repair, will fall into disuse and eventually pass out of existence, the picture is designed to preserve it for the future in its condition in 1884 when Mr. Dellenbaugh spent a number of weeks on the First Mesa. He was aided in details by a fine photograph made about that time by John K. Hillers, of the United States Geological Survey.

RECENT recession measurements made by the Department of the Interior show that for a representative group of five of the single-peak system of 28 Mount Rainier glaciers, the Emmons Glacier receded 46 feet during the past year, the Nisqually 44 feet, the South Tahoma 13 feet, the Carbon Glacier 12 feet and the Paradise about six feet. The first four have a definite downward movement and are classified as "living" glaciers, while the last-named, having little if any such movement, is described as "dead." The Nisqually will retain its status for approximately 5,000 years. It is about five miles long, and is probably one of the best-known ice fields in the world because

of its accessibility. The Paradise Glacier, known for its ice caves, was measured from three points rather than one because it has a broad cliff-like front rather than a snout as a terminus. So heavy was the snowfall of the past winter that when the measurements were made in September one point was still covered to a depth of several feet. Recession measurements have been made of the Mount Rainier ice fields for several years, but the records for the Nisqually Glacier date further back than any of the others. The total recession recorded for this ice field during the past 75 years amounts to 3,118 feet.

DISCUSSION

THE OLDEST KNOWN PLANT VIRUS DISEASE

THE virus diseases of plants and animals are each year attracting more attention. Modern medicine, on the one hand, and plant pathology, on the other, developed about the modern concepts of parasitism and "the germ theory of disease." Much in modern mycology and bacteriology developed in turn out of the stimulated studies of the specific parasites concerned. Naturally work with the grosser fungi antedated that with the more minute and hence more baffling bacteria. Finally the ultra-microscopic or filterable viruses were recognized, their study requiring still more refined techniques. With the aid of such, the youngest branch of biological science, "virology," is now being outlined. And just as earlier with bacteriology so now with "virology" the developments are led by those interested in the applications to pathology, whether with diseases of man, lower animal or plant.

For many purposes of experimental study, the plant offers peculiarly attractive host material for the investigator seeking fundamental information as to the nature or characteristics and distribution of viruses. This has recently been illustrated on the historical side by a publication[1] of scholarly merit and of broad interest to students of diseases of this obscure type. The authors are especially competent to find and evaluate the evidence, Professor McKay having for years been a leading investigator of virus diseases in the Pacific Coastal regions and Dr. Warner being bibliographer of the United States Department of Agriculture. Professor McKay recently demonstrated that the so-called "breaking" of tulips, which is evidenced by curiously streaked, speckled or feathered coloration of flowers with fainter foliage mottlings, is really a "degeneration" or "mosaic" disease. It is caused by an infectious virus which is readily transmitted with infected juice, either mechanically or by aphids. Once infected, the condition persists with the bulb. Hence, new "bizarre" color strains originate which have heretofore been considered "variegations" by bulb growers and so propagated and commercially distributed.

Of much immediate interest is the fact that these floral markings are so distinctive as to permit their recognition in the earlier illustrated floral catalogues and even the early herbals. The authors not only list these, with full bibliography, but reproduce the early plates from several such herbals as Clusius (1576), and from the illustrated garden manuals of Vallet (1608), de Bry (1612), etc. Moreover, some of these writers record observations upon the origin of their "broken" strains from those of pure color, exactly as now is experimentally reproducible. Clusius, in addition, notes that offsets from "broken" bulbs always have flowers of the same broken colors, whereas seedlings from the same plants reproduce the original pure color strain. The authors trace the early records of the introduction of the tulip into the gardens of western Europe from Turkey and show not only that such "breaking" was common among these earliest Turkish introductions, but also that it was probably observed by 1555 or earlier in the Turkish gardens before the bulbs were carried from these to western Europe. Thus, the evidence seems clear that this tulip mosaic is the oldest known plant virus disease, traceable through the four centuries of recorded tulip culture of western Europe to the still earlier gardens of Turkey. Incidentally, these centuries of experience point the moral that any modern tulip fancier who introduces these variegated novelties into his tulip garden should expect to find, as did Clusius four centuries ago, that the "variegation" with attendant weakening of plants will gradually spread to other pure-color tulips. He should, therefore, promptly eliminate these diseased tulips from his garden, unless he is more interested in verifying history than in maintaining the vigor and color of his flowers.

L. R. JONES

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[1] "Historical Sketch of Tulip Mosaic or 'Breaking,' the Oldest Known Plant Virus Disease," by M. B. McKay and M. F. Warner, *National Horticultural Magazine*, 12: 179–216, July, 1933.

THE PARASITE INDUCING PEARL FORMATION IN AMERICAN FRESH-WATER UNIONIDAE

IT has been known for many years that the best pearls are formed around the transparent spherical cysts of larval parasitic worms. In Europe the cysts of larval trematodes serve as nuclei for pearls, while larval cestodes induce pearl formation in the pearl oysters of the Indian Ocean. Apparently no one

has tried to determine what parasite originates the formation of pearls in North American freshwater clams, although several investigators have mentioned incidentally that cysts of larval trematodes occur in our freshwater Unionidae and that pearls are formed around them (see Clark and Wilson 1911[1]; Wilson and Clark 1911[2]). In Central Illinois several species of clams are often heavily infested with encysted metacercariae which I have identified as the larvae of *Allocreadium ictaluri* Pearse 1924; the cysts are particularly abundant on and in the margin of the mantle. I have dissolved small pearls from *Leptodia gracilis* in acetic acid; a small metacercaria can be seen in a cyst at the center of each pearl, but not in condition to make positive identification possible. However, all the encysted metacercariae which have been found in Unionids of this locality belong to *Allocreadium ictaluri,* so there is good presumptive evidence that this is the pearl-inducing species. I have also found metacercariae of *Allocreadium ictaluri* in fresh-water clams from the Sunflower River, Miss. Professor Henry B. Ward has found encysted distomes in Unionids at New Baltimore, Mich., which I have identified as the metacercariae of *Anallocreadium armatum* (MacCallum 1895). It is possible that this species may also sometimes encyst on the mantle and induce pearl formation, but according to Professor Ward's field notes the cysts were found only in the foot. The adults of both *Allocreadium actaluri* and *Anallocreadium armatum* live in the intestine of mollusk-eating fishes; the former has been found most frequently in the channel catfish, *Ictalurus punctatus,* and the latter in the sheepshead, *Aplodinotus grunniens.*

SEWELL H. HOPKINS

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TOBACCO SMOKING AND BLOOD SUGAR

HAGGARD and Greenberg have reported, as a new observation, that a rise in blood sugar follows the smoking of tobacco.[1] They infer, since nicotine produces hyperglycaemia, that "the smoker obtains from tobacco repeated minute doses of nicotine," but they do not mention that this point has been directly established by recovery of nicotine from the urine.[2] It is not wholly clear whether it is the physiological effect of nicotine in general, or the rise in blood sugar in particular, that they refer to as "the source of at least a considerable part of the gratification from smoking." If the rise in blood sugar is credited with this rôle (and there seems to be no other evidence of psychological effects of fluctuations in carbohydrate metabolism within normal limits, except in connection with hunger contractions of the stomach), it may be pertinent to recall that many smokers enjoy tobacco especially after meals, when the rise of blood sugar admittedly does not occur. Finally, it should be observed that this rise in blood sugar after smoking is no new discovery, but has been described repeatedly[3, 4] and is indeed the subject of a considerable monograph.[5]

D. L. THOMSON

MCGILL UNIVERSITY

A PECULIAR OPTICAL PHENOMENON

ON the evening of February 25 at about 6 to 7 P. M. there was visible a most peculiar optical phenomenon in the neighborhood of Bangor and Orono. The sky was nearly clear of clouds and the moon was about three quarters full. There was a very distinct halo around the moon, which was slightly colored toward the zenith. But most peculiar was the fact that a second circle of light was distinctly visible, which was parallel to the horizon, the zenith was the center of the circle and the moon was in the circumference of this circle. The circles distinctly crossed and could each be seen entire. At a short distance outward from the moon and from the points of intersection bright places appeared. This was no doubt due to the intersection of the second halo with the larger circle, although the rest of the second halo was not visible.

Considerable discussion has arisen as to the cause of the large circle with the zenith as its center. Perhaps some of your readers could explain this in a later issue if you would be so kind as to print this request.

Might this be due to the moonlight reflected from the snow-covered earth?

A. L. FITCH

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THE DISGRACE OF GERMAN SCIENCE

THE material and moral degradation of scientific men in Germany because they are liberals or of Jewish descent (so-called non-Aryans) continues uninterruptedly, and not a voice is raised there in protest. It seems that only the religious leaders have sufficient courage of their convictions to protest against the government's infringements upon their rights and beliefs. Is it possible that no groups of scientists or technicians have courage enough to protest against

[1] H. W. Clark and C. B. Wilson, "The Mussel Fauna of the Maumee River," U. S. Bur. Fish. Doc. 757; 72 pp., Wash., 1911.

[2] C. B. Wilson and H. W. Clark, "The Mussel Fauna of the Kankakee Basin," U. S. Bur. Fish. Doc. 758; 52 pp., Wash., 1911.

[1] H. W. Haggard and L. A. Greenberg, SCIENCE, 79: 165, 1934.

[2] E. Dingemanse and J. Freud, *Acta Brevia Neerland. Physiol.,* 3: 49, 1933.

[3] A. Caponetto, *Klin. Wochnschr.,* 7: 701, 1928.

[4] A. I. Burstein and I. D. Goldenberg, *Biochem. Ztschr.,* 200: 115, 1928.

[5] E. Lundberg and S. Thyselius-Lundberg, *Acta Med. Scand., Suppl.,* 38: 1, 1931.

the mistreatment of their colleagues, or are they merely glad of the opportunity of a few vacancies thus left open? Is it perhaps the unceasing and relentless propaganda which threatens to spread its vicious tenets throughout the world that prevents them from seeing in the proper light what is being done, in the name of nationalism, to degrade and dehumanize the best that there is in man?

Perhaps it is not sufficiently known that, in addition to the hundreds of professors who have been and are still being removed from their positions, in addition to hundreds of physicians and lawyers who are prevented from practising their profession, editors are removed from their positions without even proper credit, and men of science and learning are degraded in more ways than one. A few of the more recent illustrations may suffice.

Those professors who were left at the universities because of their war service record are being gradually removed on account of students' strikes. Neither the government nor the faculty does anything about it, and the former seems not only to acquiesce in that but takes advantage of the situation to remove the remaining professors.

At the recent meeting of the Society of German Chemists,[1] it was decided that non-Aryans could not be active members of the society.

The names of Haber, Willstätter and Neuberg have been left out as editors (honorary, without pay) from the *Berichte deutscher Chemischer Gesellschaft* and only those of Hofmann, Wollmer and Leuchs left! Compare the difference in reputation of the three first named with the latter ones!

The name of Grassmann was added to that of Neuberg as editor of the *Biochemische Zeitschrift*. How long will it take before the name of the latter is dropped altogether?

Hans Pringsheim has been removed as editor of *Cellulosechemie*, without even the customary decency of inserting a statement that he was former editor of this journal (has actually built it up)! These illustrations could be multiplied many times.

And so the process goes on! But how far! Is there no courage left among the men of science to say "Thou shalt go no further"? There were times when men of science were willing to die for their convictions! Or are these only cheap mountebanks that do not deserve the name of "Men of Science," that do not dare to raise the voice of protest against the mistreatment of their colleagues, teachers and friends? Many of them actually assist in spreading vicious propaganda by enclosing among their reprints cheap claptrap about the Polish Corridor, about France's mistreatment of Germany and about other matters on which they have no accurate or verifiable knowledge. Should a rare and solitary protest reach them from abroad, they dismiss it easily as foreign propaganda against Germany.—*A Correspondent.*

[1] Verein deutscher Chemiker, Berlin, November 28, 1933—*Angew. Chemie*, 46 (50): 790, 1933.

REPORTS

GRANTS OF THE AMERICAN PHILOSOPHICAL SOCIETY

THE American Philosophical Society has made grants during 1933–1934 to the following:

Admiral Richard E. Byrd to make the echo sounding equipment available for the Byrd Antarctic Expedition.

Warren K. Moorehead to help finance the work he is undertaking on the Amerinds of New England.

William B. Scott to enable him to prepare a monograph on the fossil mammals of the White River formation in Dakota and Nebraska.

James T. Young in support of a survey of local rural government in Pennsylvania.

Robert A. Millikan in support of work on the determination of the geological time scale in years.

Alfred C. Lane in support of a cooperative research in physics and chemistry as to the relations of the various radio-active elements and the lead produced therefrom.

Felix E. Schelling, chairman of the Supervisory Committee on the Variorum Shakespeare of the Modern Language Association of America, for the completion of the two plays now in progress and being edited by Professors Black and Shaaber for the Shakespeare Variorum.

W. F. G. Swann for investigation in nuclear physics.

The Academy of Natural Sciences of Philadelphia.

John R. Murlin for investigations into the effects of high frequency currents on the energy metabolism of animals and the human subject.

P. W. Whiting for investigations on genetics and sex-determination of the parasitic wasp Habrobracon.

A. J. Dempster for investigations of the exact atomic ratios of the chemical elements by the methods of mass spectroscopy.

Edward L. Bowles and Henry G. Houghton, Jr., in support of an investigation of the transmission of radiation through fog.

J. Lincoln Cartledge in support of an investigation of the factors which are responsible for increased mutation rate in aged seeds of Datura; the effects on the mutation rate of temperature, moisture, oxygen supply and other experimentally applied factors,

and the effects of aging seeds under natural conditions as when buried in the soil; the study and determination of the changes brought about by these means.

A. V. Grosse for one year—the extraction of 1 gram of the radioactive elements 91—protactinium—from about 5 tons of raw material and its isolation in the form of pure salts and finally in the metallic state itself.

George M. Reed for one year—influence of the nutrition of the host on smut development.

Dr. V. Slipher for the Lowell Observatory for extending the search of the ecliptic covering a wide belt of the sky, for outer members of the solar system, because the small size and faintness of Pluto made it seem not improbable that other similar bodies would be found, and showed that such an exacting and complete search would be required to give answer to this important question.

Dr. Edward L. Thorndike for one year's work in support of a research in the psychology of animal and human learning.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN ADJUSTABLE STAGE FOR MICROSCOPES

A STAGE which may be raised or lowered to bring various parts of a dissection into focus, while both hands are occupied with the dissecting instruments, is here described. In the dissection of small animals, and especially insects, it is often an advantage to continually adjust the microscope to obtain a depth of focus upon the region which is being examined and at the same time have both hands free for the dissecting work. This adjustable stage offers the above advantage. In addition, there is the added factor that it may be easily and cheaply constructed in any laboratory and with materials which are nearly always available. The type here described is small, compact and very convenient. It may be placed, with ease, beneath any type-dissecting microscope. The dimensions, however, are flexible and the instrument may be made of almost any size. Plywood or any metal of suitable thickness may be used for the building.

The apparatus consists of three parts, as shown in Fig. 1: base (A), stage (B) and revolving disk or

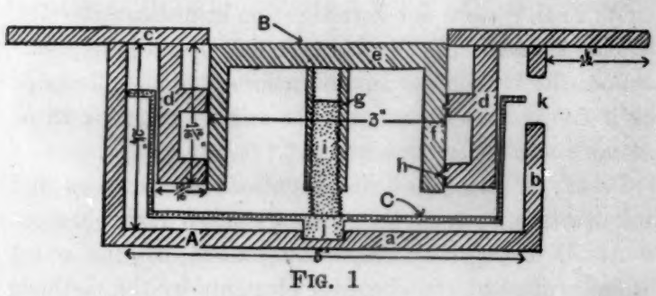

FIG. 1

rotor (C). The base (A) has an inside dimension of 5″×5″ (a) with a height of 2¼″ (b). The top (c) is 5″×5″, with an additional 1½″ extension on two opposite sides forming the arm rests. In the center of the top a 3″×3″ opening is cut. On the under side of the top are placed four braces (d) which serve as a sleeve in which the stage is raised and lowered. These are put into the positions shown and are of the dimensions given. The figure is a side view and therefore only two braces are shown.

The stage (B) is an inverted cup with a square base (e) 3″×3″ and a depth of 1¾″ (f). In the exact center of the bottom of the cup is placed a nut, which is 1¾″ long (g). Two longitudinal grooves are cut in the outside wall along the length of the sides (f) of the stage. These grooves will fit into notches (h) and prevent the stage from rotating as it is raised and lowered.

The rotating disk or rotor (C) is a circular disk with a diameter of five inches and shaped as shown. In the center is placed a screw (i) threaded to fit the nut (g) on the stage. Directly on the opposite surface of the disk a collar (j) is placed which fits snugly into a 1/16″ socket made into the base as indicated. A slot is cut in the side (b) of the base (A), as shown at (k). It is at this point that the rotor is exposed and the stage adjusted. This opening is located directly beneath one of the arm rests mentioned above.

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A SIMPLE METHOD FOR THE ISOLATION OF GLUTATHIONE FROM YEAST

ABOUT 4 kgms of fresh baker's yeast were mixed with two liters of water. After one hour six liters of 95 per cent. alcohol, to which eight cc of conc. sulfuric acid were added, were poured in a slow stream into the yeast with constant stirring. The suspension of yeast was allowed to stand at room temperature for 3 hours and was stirred occasionally. After that it was filtered off under suction in large Buchner's funnels. To the filtrate were added 400 cc of copper sulfate solution, which was prepared immediately before use by mixing a 3 per cent. solution of $CuSO_4$ in water with an equal volume of 95 per cent. alcohol. The precipitated substance was allowed to settle for a few hours; the supernatant liquid was decanted; the sediment was centrifugalized off and washed with alcohol and ether. It was suspended

immediately in water and decomposed by sulfur hydrogen. The solution of glutathione thus obtained was freed from sulfur hydrogen by aeration; the substance was oxidized and further purified by a crystalized glutathione-copper compound.[1]

If small amounts of glutathione are needed, it is sufficient to mix 100 gms of yeast with 30 cc of water and to add 150 cc of 95 per cent. alcohol, containing about 0.2 cc of H_2SO_4. After one hour the precipitate is centrifugalized off, and the supernatant liquid, filtered if necessary, is mixed with 6 cc of 1.5 per cent. solution of copper sulfate in 45 per cent. alcohol. The precipitated substance is centrifugalized off. The mechanism of the reaction involved in the precipitation lies here in the reduction of cupric to cuprous ions, which form an insoluble compound with the reduced glutathione.

The yield of glutathione in the above method is not quantitative and depends upon the correct proportion of the reagents (H_2SO_4 and $CuSO_4$), which should not be used in a too small or too large quantity.

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SPECIAL ARTICLES

METHYLENE BLUE AND GASSED PLANTS

The recent publications of Brooks[1] on the effectiveness of methylene blue in antidoting hydrocyanic acid and carbon monoxide poisoning in animals raised the question of how this dye would influence gassed plants. Illuminating gas leaks in greenhouses and in the soil in the vicinity of shade trees present a wide range of problems of practical as well as theoretical interest. Commercial illuminating gases contain carbon monoxide and frequently hydrocyanic acid as well as many other constituents which are singly or collectively toxic to plants.

In this study methylene blue was supplied to tomato plants exposed to illuminating gas or to ethylene. The characteristic behavior of the leaf petioles of tomato plants when exposed to these, as well as other gases, to move downward and when placed in fresh air to move upward was the response and recovery feature followed. The roots of pot-grown tomato plants were washed free of soil and placed in a nutrient solution before being subjected to relatively low concentrations of illuminating gas or ethylene in a closed chamber. After twenty-four hours' exposure to either of these gases the nutrient solutions were renewed. One half of the plants received methylene blue at concentrations from 1:100,000 to 1:1,000,000 of the nutrient solution. The remaining plants did not receive this dye. Both lots were then placed in a well-ventilated greenhouse. The movements of the petioles were followed by measuring the angles formed by the third and fourth leaf petioles and the stem above them before the gassing, immediately after and at two and four days following removal from the gas chamber to note the recovery.

The detailed results of the experiments conducted during the summer of 1933 will be published elsewhere. The following abbreviated table, however, gives the trend of the results.

These and the complete results of this investigation are interpreted as indicating that methylene blue sup-

[1] *Biochem. Ztschr.*, 242: 249, 1931.

[1] M. M. Brooks, *Am. Jour. Physiol.*, 102: 145, 1932; *Proc. Soc. Exp. Biol. and Med.*, xxix: 1228, 1932; *Am. Jour. Physiol.*, 104: 139, 1933; *Proc. Exp. Biol. and Med.*, xxx: 493, 1933.

Expt. no.	Plants exposed to:	Conc. of methylene blue	Recovery* of petioles in: Two days	Four days
1	Illuminating gas	none	19.4 per cent.	——
	1:100	1:100,000	36.5 " "	——
3	Ethylene	none	66.8 " "	75.7 per cent.
	1:10,000	1:1,000,000	72.7 " "	78.5 " "
5	Illuminating gas	none	80.0 " "	75.4 " "
	trace	1:500,000	65.4 " "	87.1 " "
6	Ethylene	none	50.0 " "	71.1 " "
	1:1,000	1:500,000	55.5 " "	89.9 " "

* Recovery is given as the percentage of the average upward movement of the petioles after the gassing on the average downward movement in response to the gassing.

plied to the roots is effective in aiding the recovery of tomato plants that have been exposed to illuminating gas and to ethylene.

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RESTING SPORANGIA OF CLADOCHYTRIUM

IN the course of experiments to determine the host range and pathogenicity of *Cladochytrium replicatum* Karling and its growth on artificial media during the past spring and summer, an abundance of resting sporangia were found in most of the host tissues examined. These sporangia are predominantly spherical in shape and vary from 9 to 21 μ in diameter, but oval, lemon-shaped and elongated ones are not uncommon. If the host cell is small and narrow they may frequently fill it and assume its characteristic shape. All resting sporangia so far observed have been markedly hyaline in color, with a fairly thick wall. A large globule usually occupies the center of the cell and is generally hyaline, also, but may sometimes be golden-orange or brown in color. In elongated sporangia two or more such globules may be present.

The outer wall appears to be predominantly smooth, but in a large number of sporangia fine, hyaline, straight filaments or spines radiate from the surface. As many as thirty such slender threads, varying from 4 to 9 μ, have been counted on a single sporangium. Oftentimes they are so fine and colorless as to be almost invisible, and it is not yet certain that they are of universal occurrence or belong to the sporangium at all. Frequently they appear like long filamentous bacteria clinging to the surface. If they are a part of the outer wall, they are obviously unlike the spines on the resting spores of the majority of chytrids.

So far only four cases of germination have been observed. A short sporangial neck is developed, the contents undergo cleavage and a considerable number of zoospores are formed. These pass out of the neck in rapid succession and lie quiescent at the mouth for a few moments before becoming actively motile. Germination and zoospores formation thus appear to be very similar to the same process in ordinary zoosporangia.

The resting sporangia of *Cl. replicatum* are markedly different from those of *Physoderma* and *Urophlyctis* in color, shape and method of germination, according to these observations. On this basis it is now possible to distinguish the genus *Cladochytrium* quite clearly from the other two. Heretofore there have been no sharp lines of distinction between the genera, and many mycologists have separated *Cladochytrium* from *Physoderma* and *Urophlyctis* on the basis of lack of resting spores. In the latter two genera, according to Schroeter, Magnus, Clinton, Bally, Tisdale, Bartlett and others, the resting sporangia are usually dark brown in color, flattened slightly on one side, and at the time of germination dehisce by throwing off a large disk or cap. In *Cladochytrium*, on the other hand, they are predominantly spherical and hyaline, and germinate by the formation of a well-defined exit tube or neck.

JOHN S. KARLING

DEPARTMENT OF BOTANY
COLUMBIA UNIVERSITY

THE PRESENCE OF PHOSPHORUS IN THE SUN

ON the basis of spectrographic evidence phosphorus may now with considerable assurance be added to the long list of elements present in the sun. The observations consist of measurements of recent infrared solar spectrograms which, when compared with the laboratory data of Kiess,[1] show significant correspondence in position and intensity for five lines, all faint in the sun. The apparent absence from the solar spectrum of other phosphorus lines in this region is well explained by the fact that they would be expected to be still fainter and are thus beyond the power of our instruments. The only other known lines of phosphorus, besides these in the infra-red, lie in that part of the ultra-violet region that is rendered inaccessible for astronomical spectroscopy by the opacity of the earth's atmosphere. Full details of this work will be published elsewhere. The strongest lines are at λλ9796, 10529 and 10581 and the corresponding solar intensities are −3, −1 and −1 respectively.

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PRINCETON UNIVERSITY OBSERVATORY

HAROLD D. BABCOCK

MOUNT WILSON OBSERVATORY,
CARNEGIE INSTITUTION OF WASHINGTON

C. C. KIESS

BUREAU OF STANDARDS,
WASHINGTON, D. C.

[1] *Bureau of Standards Journal of Research*, 8: 393 (RP 425), 1932; also unpublished material.

BOOKS RECEIVED

CALVIN, ROSS. *Sky Determines: An Interpretation of the Southwest.* Pp. xii + 354. Illustrated. Macmillan. $2.50.

DUGGAN, STEPHEN. *The Two Americas.* Pp. xx + 277. Maps. Scribner's. $1.75.

HUDDLESON, I. FOREST. *Brucella Infections in Animals and Man.* Pp. xiv + 108. Illustrated. Commonwealth Fund.

JACOBSON, EDMUND. *You Must Relax.* Pp. xv + 201. 27 figures. Whittlesey House, McGraw-Hill. $1.50.

SHULL, A. FRANKLIN, GEORGE R. LARUE and ALEXANDER G. RUTHVEN. *Principles of Animal Biology.* Fourth edition. Pp. xiv + 400. 290 figures. $3.50. *Laboratory Directions in Principles of Animal Biology.* Fourth edition. Pp. ix + 100. 4 figures. $1.00. McGraw-Hill.

SWANN, W. F. G. *The Architecture of the Universe.* Pp. ix + 428. Macmillan. $3.75.